Southern California Priority Corridor
Showcase Program Evaluation

Transportation System Impacts Cross-Cutting Evaluation Report

FINAL

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Abbreviations & Acronyms

ATIS	Advanced Traveler Information System
ATMIS	Advanced Traffic Management & Information System
ATMS	Advanced Transportation Management System
AVL	Automatic Vehicle Location
Caltrans	California Department of Transportation
CCTV	Closed-circuit Television surveillance camera
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CHP	California Highway Patrol
CM	Configuration Management
CMP	Configuration Management Plan
CMS	Changeable Message Sign
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off-the-Shelf
CTC	California Transportation Commission
CVO	Commercial Vehicle Operations
CW	Corridor-wide
CWATIS	Corridor-wide Advanced Traveler Information System Project
CWATMS	Corridor-wide Advanced Transportation Management System Project
CWCVO	Corridor-wide Commercial Vehicle Operations Project
CWSIP	Corridor-wide Systems Integration Project
CWSPP	Corridor-wide Strategic Planning Project
DOIT	Department of Information Technology
DRI	Caltrans Division of Research & Innovation (formerly NTR)
EAP	Evaluation Activity Plan
EMC	Event Management Center
EP	Evaluation Plan
FHWA	Federal Highway Administration
FSR	Feasibility Study Report
FTA	Federal Transit Administration
FTE	Full-Time Equivalent (one full-time employee)
GPRA	Government Performance and Results Act
GUI	Graphical User Interface
HP	Hewlett-Packard
HQIT	Headquarters - Information Technology (division of Caltrans)
IDL	Interface Definition Language
IPP	Implementation Phasing Plan
IPR	Intellectual Property Rights
ISP	Information Service Provider
ISSC	Information Systems Service Center (division of Caltrans)
ISTEA	Intermodal Surface Transportation Efficiency Act (of 1991)
ITS	Intelligent Transportation Systems (formerly IVHS)
IVHS	Intelligent Vehicle and Highway Systems

IWS	Integrated Workstation
LACDPW	Los Angeles County Department of Public Works
LADOT	City of Los Angeles Department of Transportation
LAN	Local Area Network
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MTA	Los Angeles County Metropolitan Transportation Authority
MTBF	Mean Time Between Failure
NDA	Non-Disclosure Agreement
NET	National Engineering Technology Corporation
NTCIP	National Transportation Communications for ITS Protocol
NTR	Caltrans Division of New Technology & Research (now DRI)
OCMDI	Orange County Model Deployment Initiative
OCTA	Orange County Transportation Authority
O&M	Operations and Maintenance
OS	Operating System (such as Windows™, Unix, Linux, et. al.)
PC	Personal Computer (Windows™-based)
PeMS	Performance Measurement System
PoP	Period of Performance
RAMS	Regional Arterial Management System (aka. Traffic Signal Integration)
RAVL	Regional AVL (aka. Transit Management System)
RCTC	Riverside County Transportation Commission
RFP	Request for Proposals
RIWS	Regional Integrated Workstation
RTDIE	Regional Transit Database Information Exchange
RTP	Regional Transportation Plan
RTPA	Regional Transportation Planning Agency
RWS	Remote Workstation
SANBAG	San Bernardino Association of Governments
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCPCSC	Southern California Priority Corridor Steering Committee
TANN	Traveler Advisory News Network
TEA-21	Transportation Equity Act for the 21st Century
TIC	Traveler Information Center
TMC	Transportation Management Center
TOC	Traffic/Transportation Operations Center
TSP	Traffic Signal Priority
USDOT	United States Department of Transportation
VCTC	Ventura County Transportation Commission
VDS	Vehicle Detector Station
VHT	Vehicle Hours Traveled
VMT	Vehicle Miles Traveled
VOS	Volume/Occupancy/Speed
WAN	Wide Area Network

Executive Summary

This report is one of five cross-cutting evaluation reports prepared under the Southern California Priority Corridor Showcase Evaluation. Each Showcase cross-cutting report addresses one of the Showcase Program's five evaluation goals:

- ✓ System Performance
- ✓ Costs
- ✓ Institutional Impacts
- ✓ Transportation and Traveler Information Management
- ✓ Transportation System Impacts

This cross-cutting report aggregates and summarizes the cumulative knowledge gained from the Showcase Program projects with regards to user acceptance and the usage of transportation data and information. More specifically, this report addresses the usage of transportation information by public agencies and the usage of traveler information by the general public.

Background

As required by federal law, all Intelligent Transportation System (ITS) projects that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. This document is one of 23 reports produced as part of the Southern California ITS Priority Corridor Showcase Program Evaluation to help planners and decision-makers at the federal, state and local levels make better-informed decisions regarding future ITS deployments.

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which Intelligent Transportation System (ITS) could have particular benefit. Southern California suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels. The Southern California Priority Corridor is one of the most populated, traveled, and visited regions in the country, and consists of four adjoining regions:

- Los Angeles/Ventura
- Orange County
- San Diego County
- Inland Empire (San Bernardino and Riverside Counties).

The ITS Showcase Program is one of several programs that have been implemented in Southern California's Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts. The Showcase Program consists of 17 ITS projects that collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. Each Showcase project deploys a piece of this corridor-wide ITS network, including regional Advanced Traveler Information Systems (ATIS), regional Advanced Transportation

Management Systems (ATMS), and regional and interregional communications infrastructure. Eleven of the projects develop systems specific to a particular region, while the remaining six provide Corridor-wide services and inter-regional infrastructure. The projects are listed in the table below.

PROJECT	DESCRIPTION
Corridor-wide Projects (6)	
Scoping & Design (Showcase Kernel)	Designs and implements four "Kernel" servers that help manage the interregional Showcase Network. One Showcase Kernel will be installed in each of the four Southern California Caltrans Districts.
Strategic Planning/System Integration (CWSPP)	Works to ensure that the systems of the Priority Corridor are interoperable and sustainable by developing a Configuration Management process.
CWATIS	Will provide Concept of Operations (ConOps), System Requirements and High Level Design for an Integrated Workstation (IWS).
CWATMS	Intended to build on the high-level planning efforts of the CWATIS project and develop the IWS.
Interregional Rideshare Database	Links San Diego's transit database with the transit database at Southern California Association of Governments (SCAG) in order to make SCAG's transit based Itinerary Planning tool more robust. The change will broaden the system's coverage from the LA/Orange County area to include San Diego as well.
CWCVO	Primarily intended for Commercial Vehicle Operations (CVO), the Showcase portion of CWCVO develops a server that fuses transportation data and provides an interface for partner Information Service Providers (ISPs) to access it for value-added redistribution.
San Diego Regional Projects (5)	
IMTMS/C	Optimizes and coordinates freeway and surface street operations with public and private transportation systems by integration of intermodal transportation information, and intermodal transportation management systems. Creates an ITS network for the San Diego region.
InterCAD	Improves incident management by linking the Computer-Aided Dispatch (CAD) systems of law enforcement and emergency response agencies in San Diego.
Mission Valley ATMIS	Optimizes traffic and transit operations in the vicinity of Qualcomm Stadium. The project coordinates with the IMTMC/S project.
Transit Management System (RAVL)	Installs Automatic Vehicle Locator (AVL) on San Diego Transit buses, as well as provides traffic signal priority at a number of downtown intersections.
Traffic Signal Integration (RAMS)	Integrates remote management of traffic signals across multiple jurisdictions in San Diego County.
Los Angeles/Ventura Regional Projects (3)	
IMAJINE	Creates an integrated network comprising four transportation management systems in Los Angeles County: Caltrans District 7 freeway management system, Los Angeles County Metropolitan Transit Authority (LACMTA) fixed route transit database, Access Services Inc. (ASI) demand-based paratransit services, and the City of South Gate arterial traffic signal control system.
Integrated Mode Shift	Provides transit-related traveler information in the form of trip itineraries. Also provides driving directions for automobile trips.
LA/Ventura ATIS	Implements an ATIS for LA County and some Ventura County commuters. In the future, the system may also bundle public data from various sources and make it available to ISPs.

Orange County Regional Projects (2)	
TravelTIP	Fuses data from multiple jurisdictions throughout Orange County and disseminates it to travelers via a website, a Highway Advisory Telephone (HAT) system, and three kiosks.
OCMDI	Extends the dissemination of traveler information in Orange County by providing data to private sector ISPs through a non-profit data broker. The data broker is called the Traveler Advisory News Network (TANN). TANN's goal is to be the single interface for traveler information in California. TANN establishes connections with public and private data sources, and then acts as a broker to provide data and/or information services to ISPs and other media outlets.
Inland Empire Regional Projects (1)	
Fontana-Ontario ATMIS	Built a Traffic Management Center (TMC) for the City of Fontana and a regional ATIS to help manage traffic from sources such as the Ontario Convention Center, Ontario Mills Mall, Ontario International Airport and the California Speedway in Fontana. Additionally, the project integrates the new TMC with the Showcase Network via the Inland Empire Kernel located at Caltrans District 8.

The Showcase Evaluation studied each of these 17 projects, and a project evaluation report has been prepared for each one.

This cross-cutting report aggregates and summarizes the cumulative knowledge gained from the Showcase Program projects with regards to Transportation System Impacts.

Evaluation Findings, Conclusions, and Recommendations

For several of the Showcase projects, an evaluation of transportation system impacts was deemed unwarranted due to observed low or insignificant usage of the deployed ITS. It was not feasible to measure their impact on travel adjustments (by time of day and route), mode shifts, traffic safety, or air quality in a comprehensive and scientifically robust cost/benefit manner because they had not sufficiently penetrated the traveler information marketplace. In short, for most of the systems, it is too early to tell what the impacts might be. These treatments must be given more time to work. A more thorough impacts analysis of these systems might be warranted once greater usage is achieved.

In the remaining cases, trends in transportation system performance were extrapolated from survey responses or calculated using archived data from California's Highway Performance Measurement System (PeMS), which is the result of a joint effort between Caltrans and the Partnership for Advanced Transit and Highways (PATH) at UC-Berkeley. PeMS collects, validates, and archives incident statistics and real-time loop detector data for highways around the state, as well as provides access to various analytical tools via a web-enabled interface. The evaluation looked for changes in transportation system performance by looking at data from before and after the various Showcase systems became operational. However, because Showcase is deployed in a "real-world" environment and is subject to many influences beyond the control of the evaluation, this report can neither show nor prove a direct or exclusive causal

relationship between the Showcase systems and the trends observed. The reader should consider the Showcase systems to be among the many contributing factors that may have resulted in the observed trends.

Results are summarized by evaluation objective below.

Mode shift and intermodal impacts resulting from the Showcase Projects

During the Showcase Program, the Evaluation team worked in coordination with the Volpe Center during a survey of ATIS users in the Los Angeles area. A relative minority of the survey respondents indicated that they would shift transportation modes if they learned of an incident impacting their typical route. For the morning commute ***to*** work or school, 6% indicated that they would change modes. This percentage drops to 4% for the afternoon commute home.

According to the Evaluation's TravelTIP survey, however, 10% of respondents reported having used public transit at least once as a result of learning of a traffic incident through TravelTIP. Extrapolating this percentage to all TravelTIP users, this might have resulted in as many as 960 people temporarily shifting to transit.

A larger number of TravelTIP survey respondents (15%) reported having ever switched from using transit to driving an automobile at least once as a result of TravelTIP. This may be indicative of several possible scenarios, including (but not limited to):

- Voluntary transit users (i.e., those who choose to use transit, but also have automobiles and do not necessarily depend on transit) who would rather sit in traffic in their own automobile versus aboard a bus.

- Voluntary transit users who choose to drive so as to depart at a different time or take an alternate route.

The safety-related impacts of the Showcase projects

PeMS data indicates that incident rates have decreased in the past year, while VMT has risen or stayed the same. Although this is a positive sign, the effect cannot be directly linked to the Showcase systems. Since 2002, most Showcase traveler information systems have been non-operational or underutilized by the public, with the exception of the Traveler Advisory News Network (TANN). TANN provides packaged traveler information services to traditional news media outlets such as television and radio, as well as maintains its own traveler information website.

The impact of Showcase projects on traffic congestion

In a survey of TANN website users conducted by the Volpe Center in coordination with the Showcase Evaluation team, 66% reported a likeliness to change their departure time when learning of an incident before leaving home to go ***to*** work or school. A similar number of TANN survey respondents (67%) are also just as likely to take an alternate route. 19% would run errands or make stops that they otherwise would not have made, while 27% report that they would make no changes to their morning commute and travel as normal.

Behaviors during the afternoon commute ***from*** work/school back home follow a similar trend. 71% of respondents say they would change their departure time when learning of an incident. 70% would make minor route changes, while 60% would consider entirely different routes. As might be expected, respondents are more likely to run errands or make otherwise unplanned stops during the afternoon commute (33%) than during the morning commute (19%).

Perhaps more revealing, 87% of TANN survey respondents reported that traffic information has saved them time, and 78% report that the traffic information has helped them avoid traffic problems.

The Evaluation believes that, at this time, traveler information seems to benefit a relatively small number of commuters who are exceptionally motivated to actively seek out traveler information sources. The number of such commuters is generally too small to have any significant impact on overall, network-wide traffic conditions.

The environmental impacts of the Showcase projects

Due to currently low utilization of the Showcase systems, an empirical analysis to detect their impacts on air quality and the environment was not performed. As a result, this report can only theorize about the potential impacts that traveler information might have on automobile emissions and air quality. These benefits are described in general in the following table. Since there are virtually endless scenarios to consider, the reader is invited to use the information provided to quantify his or her own specific benefits.

Anticipated Air Quality/Emissions Benefits of Using Traveler Information

Mitigating Action	Benefit
Change Departure Time	Enables vehicle to travel at higher speed by picking a time when congestion is less severe. Consider a scenario in which a common passenger vehicle typically travels 30 miles between home and work, with 7 miles of travel on local streets at 35MPH and 23 miles of travel on freeways at 65MPH. On a typical day, CO output from this trip might be roughly 434.3 grams. However, a one-mile delay (travel at 2.5MPH) on the arterial portion of the trip would inflate the total CO production to 508.08 grams, while a one-mile delay on the freeway portion would result in the production of 501.98 grams. Under this scenario, each vehicle that avoids the traffic congestion could avoid producing as much as 17% greater CO emissions.
Cancel Trip	At best, canceling the trip means that no emissions are generated. At worst, the emissions that would have been generated during the trip are simply deferred to another time.
Take Alternate Route	Since the amount of CO produced at idle is so much more than that produced at higher vehicle speeds, a vehicle could take an alternate route that is longer than the normal route taken and still produce less total exhaust emissions in the process. Using the scenario above, this vehicle could travel up to twice as far on an alternate set of arterials, or roughly 20% farther on an alternate set of freeways.
Take Transit/Carpool	One less vehicle on the road means that much fewer emissions generated. The fewer the vehicles on the road, the higher the travel speeds, which can also reduce emissions further.

The impact of Showcase projects on transit operations

At this time, the Showcase projects have had limited impact on transit operations. These findings do not mean that more significant impact might not be experienced later in the future as Southern California's population continues to grow, traffic conditions worsen, and more commuters make use of the available traveler information. In short, it is too early to tell, and a longer-term study involving more extensive user surveys would be required to draw definitive conclusions.

1 Introduction

1.1 Purpose and Scope of this Report

As required by federal law, all ITS programs that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. For the Showcase Program, this includes:

- 17 individual project evaluation reports that each address:
  - ✓ System Performance
  - ✓ Costs
  - ✓ Institutional Impacts
  - ✓ Transportation and Traveler Information Management
  - ✓ Transportation System Impacts

- 5 cross-cutting evaluation reports that aggregate data and lessons learned from across the individual projects for each of the five topic areas listed above.

- 1 Summary Evaluation Report to summarize the cumulative knowledge and lessons learned from the Showcase Program.

The complete collection of reports produced by the Showcase Evaluation is listed below.

Document Type/Title	Date	Document Number
17 Individual Project Evaluation Reports		
Corridor-wide ATIS Project Report	7/16/2003	65A0030/0033
Corridor-wide ATMS Project Report	10/28/2004	65A0030/0049
Corridor-wide CVO Project Report	10/29/2004	65A0030/0051
Corridor-wide Rideshare Project Report	11/1/2004	65A0030/0048
Corridor-wide Strategic Planning Project Report	10/29/2002	65A0030/0028
Fontana-Ontario ATMIS Project Report	11/30/2004	65A0030/0047
IMAJINE Project Report	3/17/2003	65A0030/0029
IMTMC Project Report	11/24/2004	65A0030/0054
InterCAD Project Report	4/2/2003	65A0030/0030
Kernel Project Report	5/30/2003	65A0030/0031
LA ATIS Project Report	3/15/2004	65A0030/0038
Mission Valley ATMIS Project Report	11/12/2004	65A0030/0050
Mode Shift Project Report	10/28/2004	65A0030/0052
OCMDI Project Report	2/20/2004	65A0030/0040
Traffic Signal Integration (RAMS) Project Report	11/23/2004	65A0030/0055
Transit Mgt System (RAVL) Project Report	11/30/2004	65A0030/0053
TravelTIP Project Report	2/16/2004	65A0030/0036
5 Cross-Cutting Evaluation Reports		
System Performance Cross-Cutting Report	11/30/2004	65A0030/0056
Costs Cross-Cutting Report	11/30/2004	65A0030/0057
Institutional Impacts Cross-Cutting Report	11/30/2004	65A0030/0058
Information Management Cross-Cutting Report	11/30/2004	65A0030/0059
Transportation System Impacts Cross-Cutting Report	**11/30/2004**	**65A0030/0060**
Final Summary Evaluation Report		
Showcase Program Evaluation Summary Report	11/30/2004	65A0030/0061

The Transportation System Impacts Evaluation assesses the extent to which Showcase program has an effect on traveler behavior. The evaluation looks for shifts in travel patterns – such as a redistribution of motor vehicle volumes from congested areas to under-utilized roadways, or significant changes in the use of public transportation. The evaluation also addresses travelers' attitudes about safety. The program users will be surveyed to determine whether they feel more secure or confident when traveling due to the information they obtained from the system.

The Transportation System Impacts Cross-cutting Evaluation aggregates and summarizes information from the individual Showcase projects that have been completed to-date. More specifically, this evaluation aggregates and summarizes information from across the individual Showcase projects with specific regards to Evaluation Goal 5, which includes the following supporting evaluation objectives:

Objective 5.1 – Assess mode shift and intermodal impacts resulting from the Showcase projects.

Objective 5.2 – Assess the safety-related impacts of Showcase projects.

Objective 5.3 – Assess the impact of Showcase projects on traffic congestion.

Objective 5.4 – Assess the environmental impacts of Showcase projects.

Objective 5.5 – Assess the impact of Showcase projects on transit operations.

Objective 5.6 – Assess the impact of Showcase projects on commercial vehicle operations.

*(*None of the Showcase projects significantly impacted commercial vehicle operations, and, therefore, Objective 5.6 was not evaluated)

These objectives have been refined to the set of evaluation measures and data elements found in Exhibit 1. Although some additional clarifying information may be gathered, this cross-cutting evaluation will otherwise rely on data that has already been collected as part of the individual project evaluations.

Exhibit 1 – Basis of the Transportation System Impacts Evaluation

Objective 5.1 Assess mode shift and intermodal impacts resulting from the Showcase Projects

Measures	Supporting Data
5.1.1 Change (increase) in ridership of public transit in target areas	• Ridership statistics from effected agencies
5.1.2 Change (increase) in traveler tendency to consider mode shift during target time periods	• Attitudes of travelers towards multimodal travel

Objective 5.2 Assess the safety-related impacts of Showcase projects

Measures	Supporting Data
5.2.1 Change (decrease) in frequency and severity of accidents in target areas during target time periods	• Number of fatal accidents • Number of injury accidents • Number of property damage accidents
5.2.2 Change (increase) in perceived safety benefits by travelers	• Attitudes/perceptions of travelers

Objective 5.3 Assess the impact of Showcase projects on traffic congestion

Measures	Supporting Data
5.3.1 Change (decrease) in delay in target areas during target time periods	• Perceived/calculated average speeds along target corridors
5.3.2 Change (increase) in average speed in target areas during target time periods	• Perceived/calculated average speeds along target corridors
5.3.3 Change (decrease) in number of stops	• Perceived/calculated queue length at ramp meters

Objective 5.4 Assess the environmental impacts of Showcase projects

Measures	Supporting Data
5.4.1 Change (decrease) in the amount of vehicle-generated pollution	• Number (%) of drivers who modify their travel plans

Objective 5.5 Assess the impact of Showcase projects on transit operations

Measures	Supporting Data
5.5.1 Change (increase) in ridership and length of trip	• Ridership statistics from effected agencies
5.5.2 Change (increase) in operational efficiency in targeted areas	• Change in routing or vehicle scheduling • Passenger capacity per vehicle
5.5.3 Change (reduction) in selected operations costs	• Cost data from effected transit agencies
5.5.4 Number of staffing changes required	• Staff changes at transit agencies

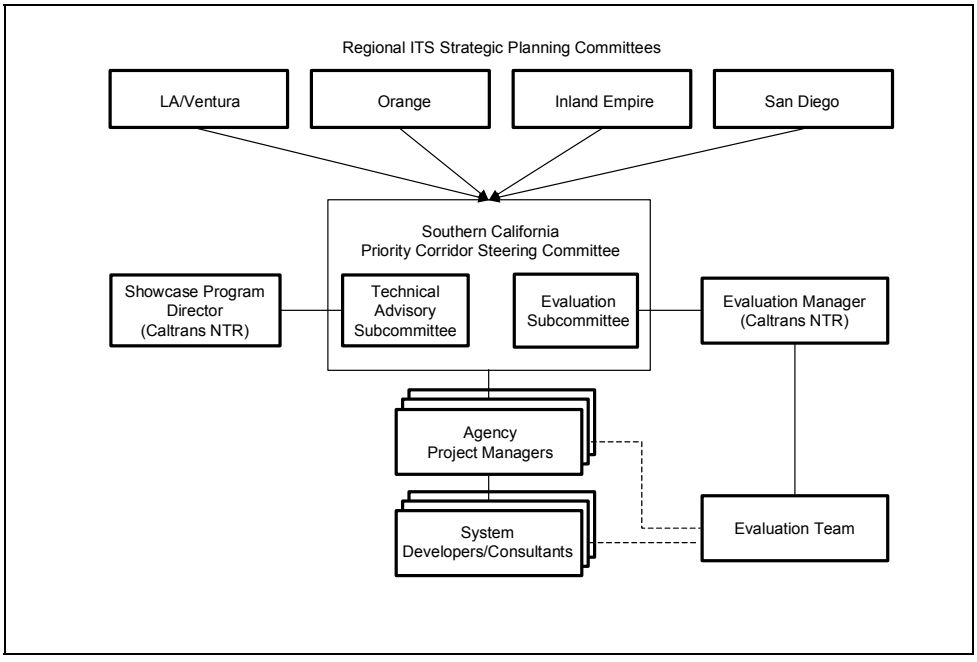
1.2 Evaluation Design and Approach

The Showcase Program's Evaluation Design is based on a set of evaluation Goals and supporting Objectives and Measures that were developed by the Evaluation Team in partnership with federal, state and local stakeholders (shown in Exhibit 2), and documented in the "Showcase Program Evaluation Approach" in 1998. Each individual Showcase project is evaluated based on an applicable subset of these goals, objectives, and measures in order to help ensure that summary evaluation results can be aggregated from across the multiple Showcase project evaluations. The Showcase Program's five evaluation Goals include:

- Evaluate System Performance
- Evaluate Costs
- Evaluate Institutional Issues and Impact
- Evaluate the Use and Management of Transportation/Traveler Information (i.e., Evaluate User Acceptance)
- Evaluate Transportation System Impacts.

The evaluation is responsive to the needs and suggestions of the Priority Corridor Steering Committee and Evaluation Subcommittee. As shown in Exhibit 2, both groups are comprised of stakeholders from the federal, state, and local levels.

Exhibit 2 – Management Structure and Organization of the Showcase Program



The Steering Committee's member agencies reflect wide representation from the Southern California Priority Corridor in terms of federal and state highway agencies, public safety, cities and counties, transit, air quality and regional planning entities, including:

- California Highway Patrol (CHP)
- Caltrans, Division of Traffic Operations (headquarters)*
- Caltrans, District 7*
- Caltrans, District 8*
- Caltrans, District 11*
- Caltrans, District 12
- City of Irvine*
- City of Los Angeles Department of Transportation (LADOT)
- City of San Diego
- Federal Highway Administration (FHWA)*
- Federal Transit Administration (FTA)
- Los Angeles County Metropolitan Transportation Authority (MTA)
- Orange County Transportation Authority (OCTA)
- Riverside County Transportation Commission (RCTC)
- San Bernardino Association of Governments (SANBAG)
- San Diego Association of Governments (SANDAG)
- South Coast Air Quality Management District (SCAQMD)
- SCAG

* Indicates an Evaluation Subcommittee member

The Evaluation Subcommittee consists of Caltrans' Evaluation Contract Manager and representatives from FHWA, Caltrans headquarters, and each of the four regions of the Priority Corridor. The Evaluation Subcommittee reviews evaluation issues and products. All draft evaluation documents are submitted to the Evaluation Subcommittee for review and comment before being finalized.

1.3 Privacy Considerations

Some of the information acquired in the interview and discussion process could be considered sensitive and has been characterized in this report without attribution. The Evaluation Team has taken precautions to safeguard responses and maintain their confidentiality. Wherever possible, interview responses have been aggregated during analysis such that individual responses have become part of a larger aggregate response. The names of individuals and directly attributable quotes have not been used in this document unless the person has reviewed and expressly consented to its use.

1.4 Constraints & Assumptions

The projects that were used to develop this report include:

- CW Rideshare
- Fontana-Ontario ATMIS
- IMAJINE
- LA/Ventura ATIS
- Mission Valley ATMIS
- Mode Shift
- OCMDI
- RAMS
- RAVL
- TravelTIP

The following projects were not used to develop this report either because they are not yet complete, or were not designed to impact transportation system performance.

- CWATIS
- CWATMS
- CWCVO
- CWSPP
- IMTMS/C
- InterCAD
- Kernel

1.5 Background

1.5.1 The Southern California Priority Corridor

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which Intelligent Transportation Systems (ITS) could have particular benefit. The Southern California Priority Corridor, illustrated in Exhibit 3, is one of the most populated, most traveled, and most visited regions in the country. Roughly two-thirds of the state's population – about 20 million people – resides in or around the Southern California Priority Corridor. It suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels.

The Southern California Priority Corridor consists of four distinct regions that correspond with the four Southern California Caltrans districts:

- Los Angeles/Ventura (Caltrans District 7)
- Orange County (Caltrans District 12)
- San Diego (Caltrans District 11)
- Inland Empire (Caltrans District 8)

Exhibit 3 – The Southern California Priority Corridor and Vicinity

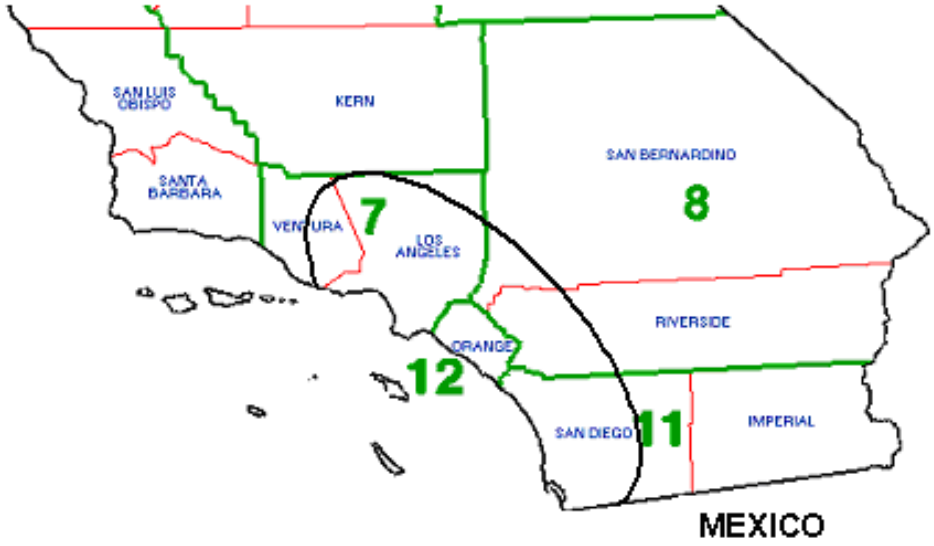


Exhibit 4 – Population and Number of Registered Vehicles by County

County	Population[i] (as of 1/1/2003)	Registered Vehicles[ii]* (as of 12/31/2002)	Caltrans District
Los Angeles	10 million	6.7 million	7
Orange	3 million	2.2 million	12
San Diego	3 million	2.3 million	11
San Bernardino	1.8 million	1.3 million	8
Riverside	1.7 million	1.2 million	8
Ventura	0.8 million	0.7 million	7
Imperial	0.15 million	0.1 million	11
Total	**20.5 million**	**14.5 million**	

*Includes autos, trucks, and motorcycles. Trailers not included.

1.5.2 The Southern California Priority Corridor's ITS Showcase Program

The ITS Showcase Program is one of several programs that have been implemented in Southern California's Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts.

The Southern California ITS Showcase Program consists of 17 individual ITS projects that collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. Eleven of the projects are regional in nature, while the remaining six are corridor-wide in scope. The 17 Showcase projects are listed by region in Exhibit 5. Eight of the projects were fast-tracked and

designated "Early Start" projects because of their importance as base infrastructure and potential to act as role models for the rest of the Showcase Program.

Exhibit 5 – The 17 Showcase Projects and their Status as of October 2004

Project	RFP Issued	Contractor Selected	Contract Executed	Project Underway	Project Complete
Corridor-wide					
Scoping & High Level Design (Kernel)*	✓	✓	✓	✓	✓
Strategic Planning/Systems Integration	✓	✓	✓	✓	✓
CVO🗎					
ATIS	✓	✓	✓	✓	✓
ATMS🗎					
Rideshare	✓	✓	✓	✓	✓
Los Angeles Region					
IMAJINE*	✓	✓	✓	✓	✓
Mode Shift*	✓	✓	✓	✓	✓
LA ATIS	✓	✓	✓	✓	✓
Inland Empire Region					
Fontana-Ontario ATMIS	✓	✓	✓	✓	✓
Orange County Region					
TravelTIP*	✓	✓	✓	✓	✓
OCMDI	✓	✓	✓	✓	✓
San Diego Region					
InterCAD*	✓	✓	✓	✓	✓
Mission Valley ATMIS*	✓	✓	✓	✓	✓
IMTMS/C (ATMSi)*	✓	✓	✓	✓	
Traffic Signal Integration (RAMS)	✓	✓	✓	✓	
Transit Management System*	✓	✓	✓	✓	

* Indicates an "Early Start" project.

🗎 CWCVO and CWATMS do not yet have approved workplans.

Exhibit 6 – Projects Contributing to Cross-Cutting Evaluation

	Cross-Cutting Evaluation/Objectives																	
	System Performance			Cost		Institutional Impacts & Issues					Transportation & Traveler Info Mgt.			Transportation System Impacts					
ITS Project	System Development Process	System Reliability	Showcase Program Integration	Estimate Costs Asociated w/Program's Philosophy	Estimate O&M Costs	Impact on O&M Procedures & Policies	Impact on Staffing/Skill Levels and Training	Impacts of Emerging Standards	Participation by Private Sector in Mgmt of Trans and Traveler Info	Impact on Local Planning Process, Policy Dev, & Mainstreaming of ITS Projects	Utilization of Regional/Interregional Information Integration	Utilization of Regional/Interregional Information & Traveler Information	Extent of Traveler Information Disseminated and Used by Travelers	Mode Shift & Intermodal Impacts	Safety Related Impacts	Impact on Traffic Congestion	Environmental Impacts	Impact on Transit Operations	Impact on Commercial Vehicle Operations
	1.1	1.2	1.3	2.1	2.2	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	5.6
CWATIS				X															
CWATMS				X															
CWCVO				X															
CW Rideshare	X			X							X	X							
CWSPP				X		X				X									
Fontana-Ontario	X	X	X	X	X	X	X		X		X	X	X						
IMAJINE	X		X	X	X		X	X			X	X							
IMTMC				X							X	X							
InterCAD	X			X	X							X							
Kernel	X		X	X	X			X			X								
LA/Ventura ATIS	X			X	X			X			X		X						
Mission Valley ATMIS	X			X	X	X			X	X	X	X	X						
Mode Shift	X			X	X								X						
OCMDI	X	X		X	X				X	X			X						
RAMS				X															
RAVL				X															
TravelTIP	X		X	X	X	X	X	X			X	X	X	X	X			X	

2 Evaluation Findings

This chapter provides the Showcase Program's aggregated findings regarding Transportation System Impacts. The findings are broken out by evaluation objective and geographical region within the Priority Corridor.

For several of the Showcase projects, an evaluation of the transportation system impacts was deemed unwarranted at this time due to observed low or insignificant usage of the deployed ITS. A more thorough impacts analysis of these systems might be warranted once greater usage is achieved.

In the remaining cases, trends in transportation system performance were extrapolated from survey responses, as well as calculated using archived data from California's Highway Performance Measurement System (PeMS), which is the result of a joint effort between Caltrans and the Partnership for Advanced Transit and Highways (PATH) at UC-Berkeley. PeMS collects, validates, and archives incident statistics and loop detector data for highways around the state, as well as provides access to various analytical tools via a web-enabled interface. This study looked for changes in overall transportation system performance by looking at data from before and after the various Showcase systems became operational. However, because Showcase is deployed in "real-world" environment and is subject to many influences beyond the control of the study, the evaluation can neither show nor prove a direct or exclusive causal relationship between the Showcase systems and the trends observed. The Showcase systems should only be considered to be among the many contributing factors that may have resulted in the observed trends.

Objective 5.1 – Impacts to Mode Shift and Intermodalism

Los Angeles-Ventura Region

A direct study of impacts to mode shift and intermodalism could not be performed at this time. IMAJINE's traffic signal priority feature may help encourage mode shifting by improving transit speeds and on-time performance once AVL has been added to the MTA buses. The LA-Ventura ATIS was not studied at this time because it has not yet been made accessible to the public, although it is the intent of the project sponsors to make LA-Ventura ATIS available to the public via a link on the sponsor's website.

During the Showcase Program, the Evaluation team worked in coordination with the Volpe Center during a survey of ATIS users in the Los Angeles area. A relative minority of the survey respondents indicated that they would shift transportation modes if they learned of an incident impacting their typical route. For the morning commute ***to*** work or school, 6% indicated that they would change modes. This percentage drops to 4% for the afternoon commute home.

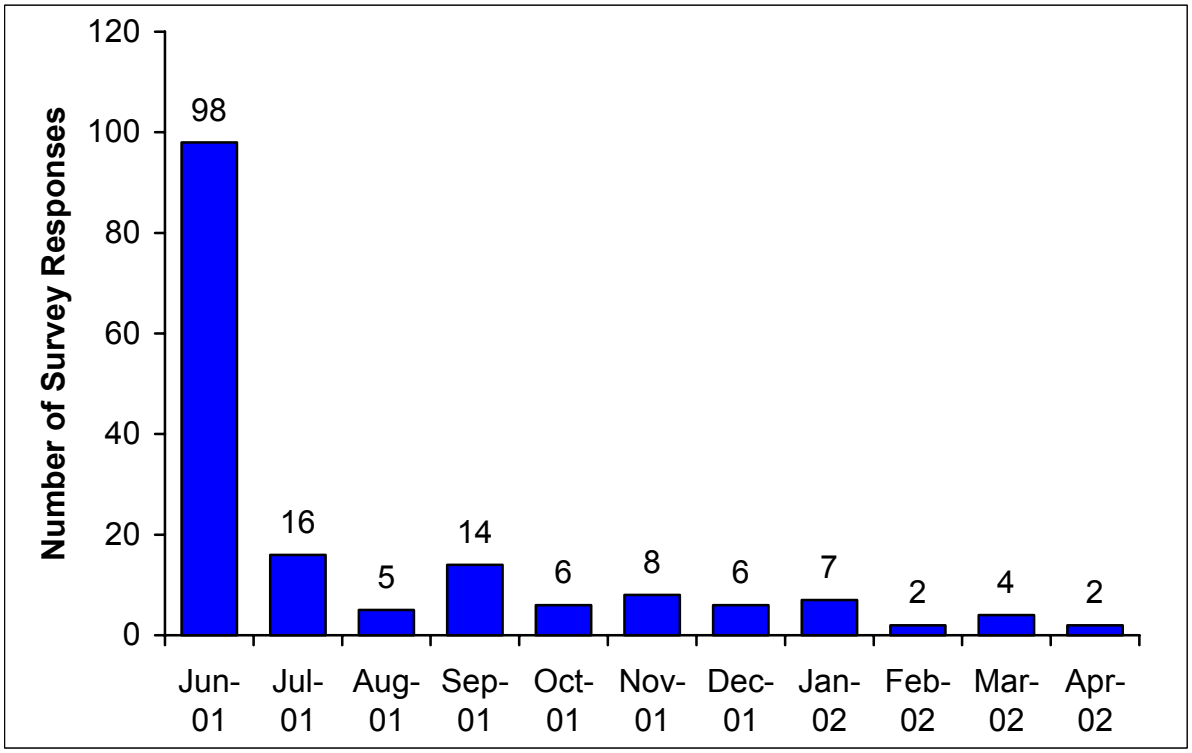
Inland Empire

The Fontana-Ontario ATMIS project was not intended to impact mode shifting or intermodalsim, so no evaluation of such impacts was performed.

Orange County Region

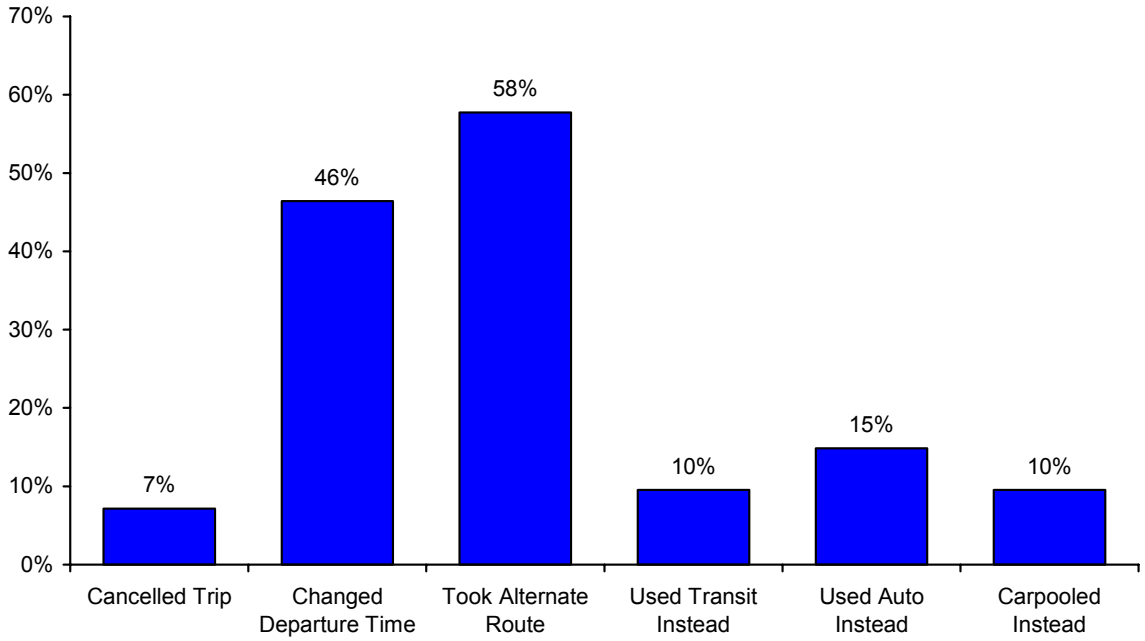
An online survey was conducted as part of the TravelTIP project to gauge and predict traveler perceptions and behavior. The chart below shows survey responsiveness for each month of data collection.

Exhibit 7 – Number of Survey Responses by Month



When questioned as to what actions they have ever taken as a result of obtaining information from TravelTIP, respondents provided the feedback found in Exhibit 8.

Exhibit 8 – Actions Ever Taken in Response to TravelTIP Information



37 percent of respondents indicated that they had ever made 'no change' and traveled as planned, in response to TravelTIP's traffic information.

According to Exhibit 8, 10% of respondents reported having used public transit at least once as a result of learning of a traffic incident through TravelTIP. Extrapolating this percentage to all TravelTIP users, this might have resulted in as many as 960 people temporarily shifting to transit.

However, a larger number of respondents (15%) reported having ever switched from using transit to driving an automobile at least once as a result of TravelTIP. This may be indicative of several possible scenarios, including (but not limited to):

- Voluntary transit users (i.e., those who choose to use transit, but also have automobiles and do not necessarily depend on transit) who would rather sit in traffic in their own automobile versus aboard a bus.

- Voluntary transit users who choose to drive so as to depart at a different time or take an alternate route.

San Diego Region

The Mission Valley ATMIS project provided a foundation for the multi-agency network of transportation management systems through the development of the Integrated Workstation (IWS), the precursor to the Regional Integrated Workstation (RIWS). During the period of the evaluation, system usage was light and periodic and the system never reached a level of stable, steady-state operation that would permit a meaningful evaluation of transportation system impacts. However, to the extent possible, anecdotal evidence gathered in interviews with stakeholders is presented here to suggest where system impacts may potentially be greatest, with wider deployment of RIWS throughout the San Diego region.

The impact of the Mission Valley ATMIS to mode shift during events at the stadium and in other vicinities where CMSs and HAR are deployed is expected to be greatest during stadium events where messages regarding transportation options to the venue can be displayed or broadcast. The impact of the Mission Valley ATMIS CMSs and HAR to encourage the use of the trolley, bus service, and carpooling, would need to be measured over subsequent events and seasons to accurately determine the changes in transit ridership, traffic flows, and parking at or near the venues affected. It is expected that transportation options information through the Mission Valley ATMIS CMS, HAR, and other transit public relations campaigns will help increase trolley ridership, use of related bus services, and carpooling to ease event-related traffic congestion and parking overflow at Qualcomm Stadium.

Objective 5.2 – Impacts to Traffic Safety and Accident Reduction

Los Angeles-Ventura Region

Caltrans District 7 provides freeway incident data to South Gate through the IMAJINE system. Once incident response plans have been developed and installed, and the system is able to automatically adjust traffic signal timings, there may be a positive impact to traffic safety and accident reduction. A more thorough impacts analysis might be warranted once the response plans have been implemented.

The LA-Ventura ATIS is designed to display traffic advisory information reported by the California Highway Patrol (CHP) to enable motorists to modify routing and departure time decisions in order to avoid delays resulting from non-recurring incidents that cause an unplanned lane closure. At the moment, the system is not yet available to the public and, therefore, does not have any impact on traffic safety or accident reduction. Once public access to LA-Ventura ATIS is established, an analysis of the impacts of providing traffic advisory information on travel behavior can be performed through quantitative survey research.

Similarly, given its limited usage, Modeshift will not have any detectable impact on traffic safety or accident reduction. Once Modeshift has achieved greater market penetration, an analysis of

the impacts of providing the travel itinerary service should be performed through a quantitative survey research.

To study the impacts of TANN's traveler information in the Los Angeles market, an analysis of archived incident data was conducted using PeMS. The term *incident* refers to any situation that impacts traffic, including accidents, debris in the roadway, bad weather, non-recurring congestion, etc. The earliest incident data in the PeMS database is from 2000, which makes it impossible to study the preconditions before TANN's start-up of operations in June 1999. However, the PeMs data is valuable for studying incident trends over the previous three years that TANN has been in operation.

Exhibit 9 and Exhibit 10, which show available PeMS data for the Los Angeles area between July 2000 and July 2004, show that while incidents have decreased in the past year, VMT has remained relatively constant. Although this is a positive sign, the trend cannot be directly linked to Showcase. The Showcase systems should be considered as being among many contributing factors that may have resulted in the observed trend.

Exhibit 9 – Total Monthly Incidents on Los Angeles County Highways

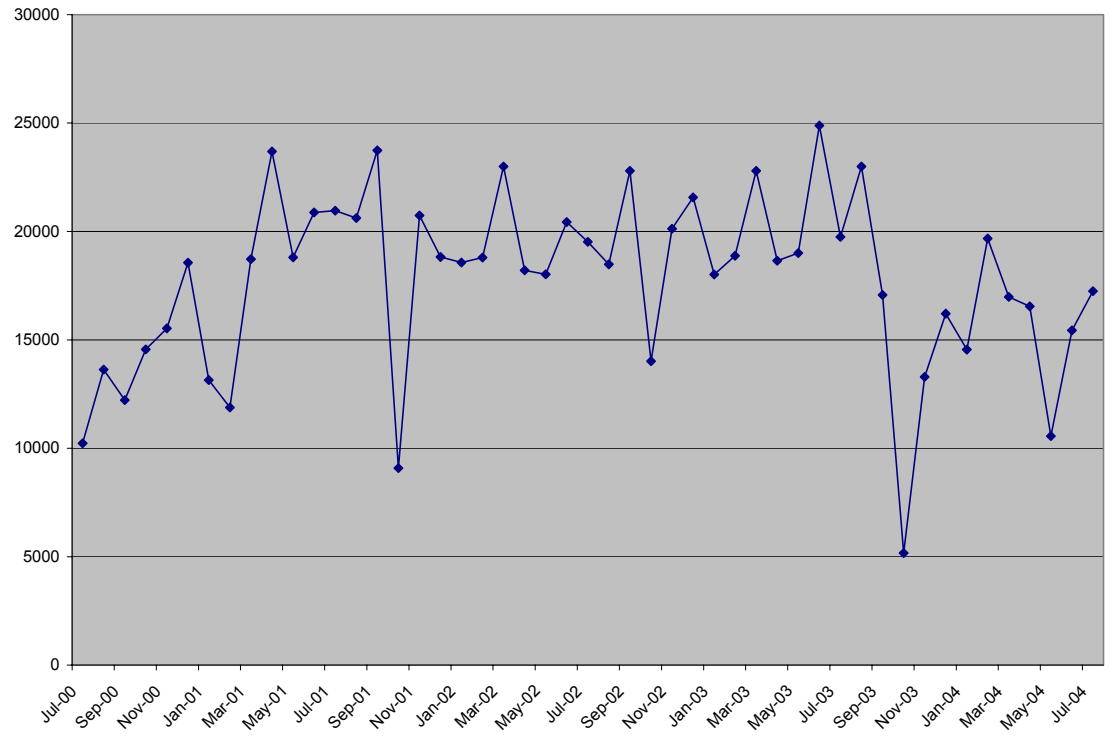
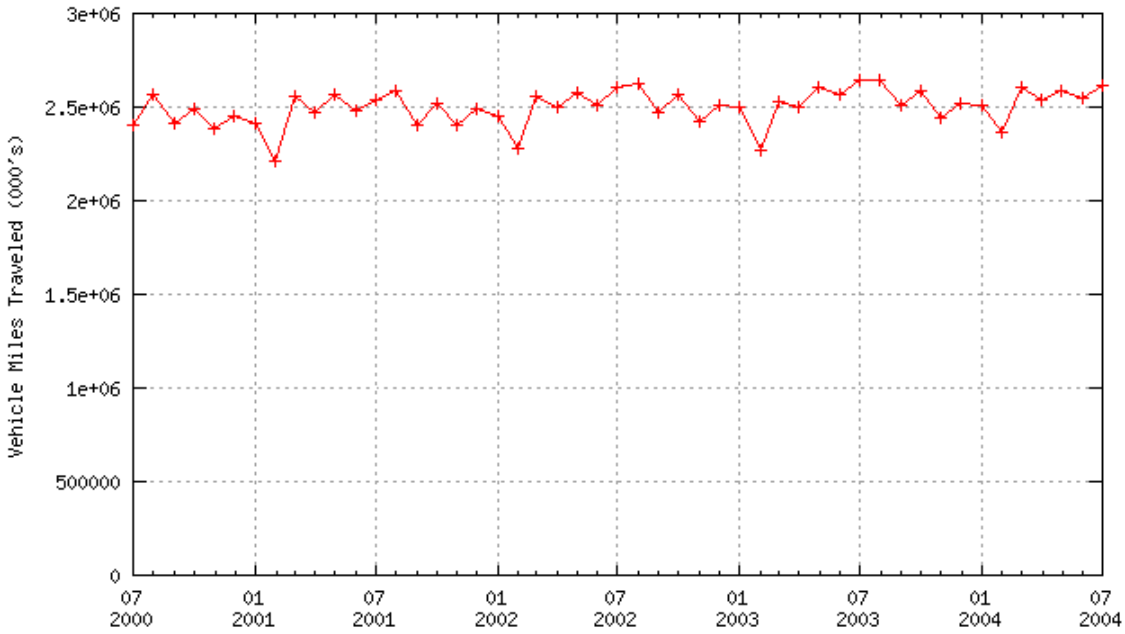


Exhibit 10 – Vehicle Miles Traveled (VMT) per Month in Los Angeles County



Inland Empire

An analysis of archived California Highway Patrol (CHP) incident data was conducted using PeMS. Exhibit 11 shows the total monthly incidents on Inland Empire highways between July 2000 and July 2004. Although Exhibit 12 shows that VMT in the Inland Empire jumped considerably in early 2003, monthly incidents continued to average roughly 9000 per month. This implies an improvement in traffic safety. While many factors, including road improvements, may have contributed to this change, the ATMIS cannot be ruled out as one of them.

Exhibit 11 – Monthly Incidents on the Inland Empire's Highways

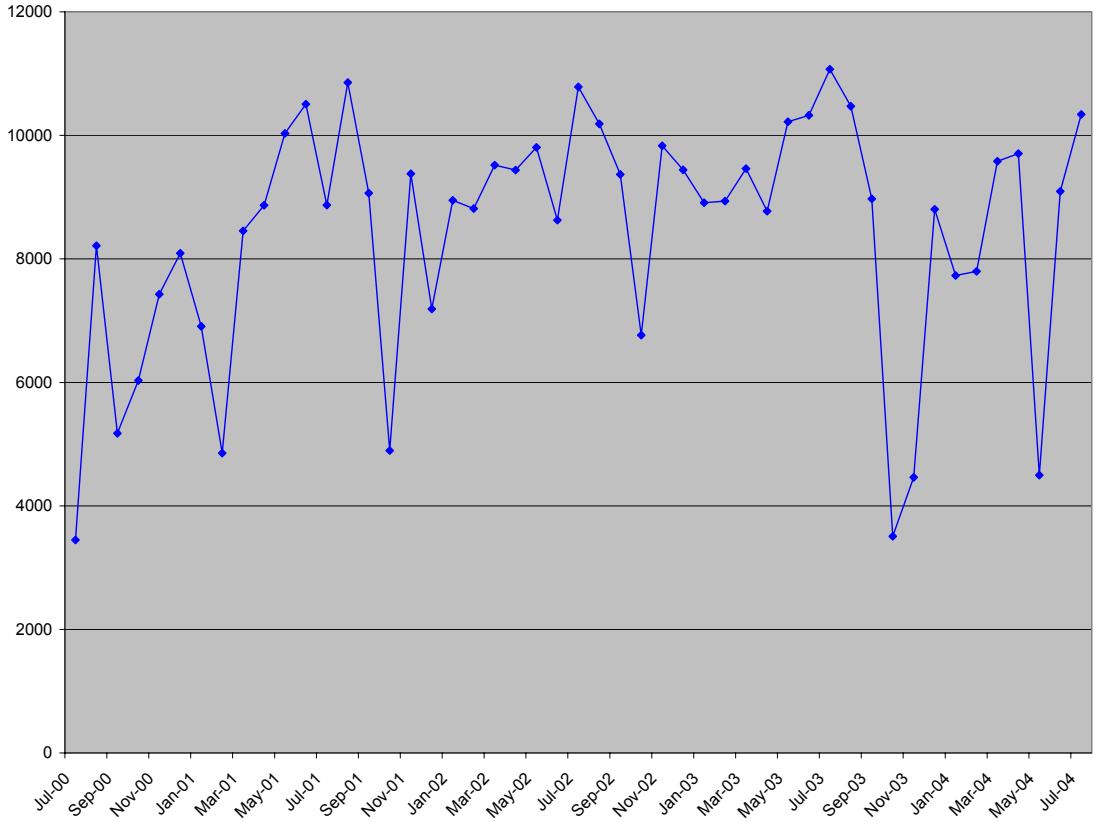
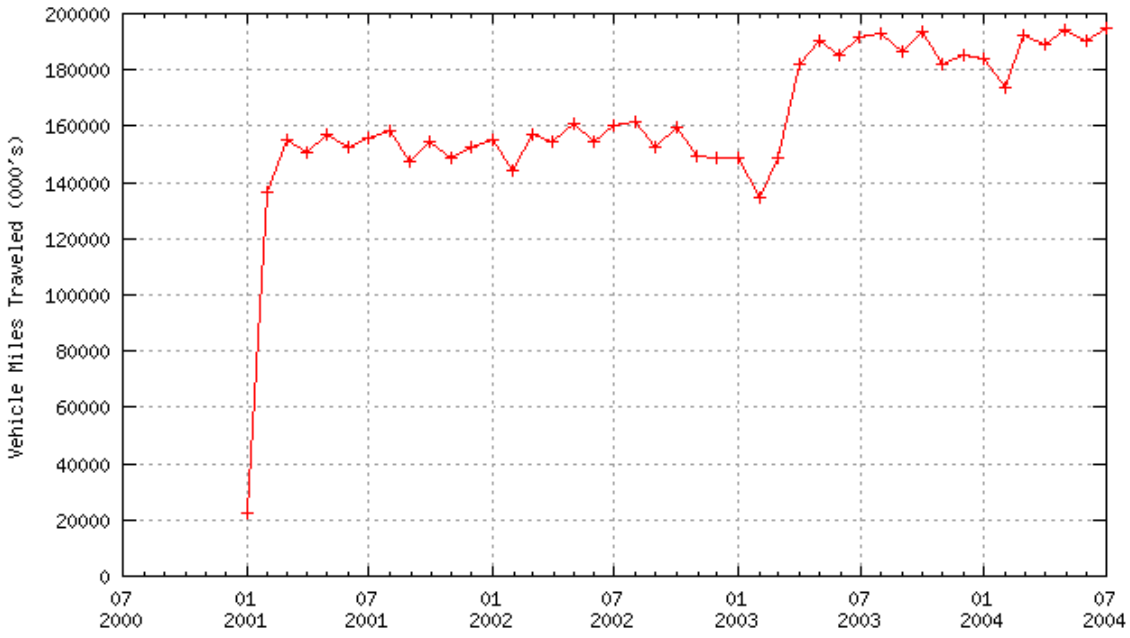


Exhibit 12 – Vehicle Miles Traveled (VMT) in the Inland Empire



Orange County Region

TravelTIP's online survey revealed that 61% of respondents use the system to obtain more information regarding accidents that they have already heard about through some other means such as radio, television, or word-of-mouth. In response to the TravelTIP information, respondents are more likely to change their departure time (46%) or take an alternate route (58%).

An analysis of archived incident data for Orange County shows that monthly incidents dropped in late 2003 while VMT remained relatively constant. Again, this implies an improvement in traffic safety. Many factors, including road improvements, may have contributed to this change.

Exhibit 13 – Monthly Incidents on Orange County Highways

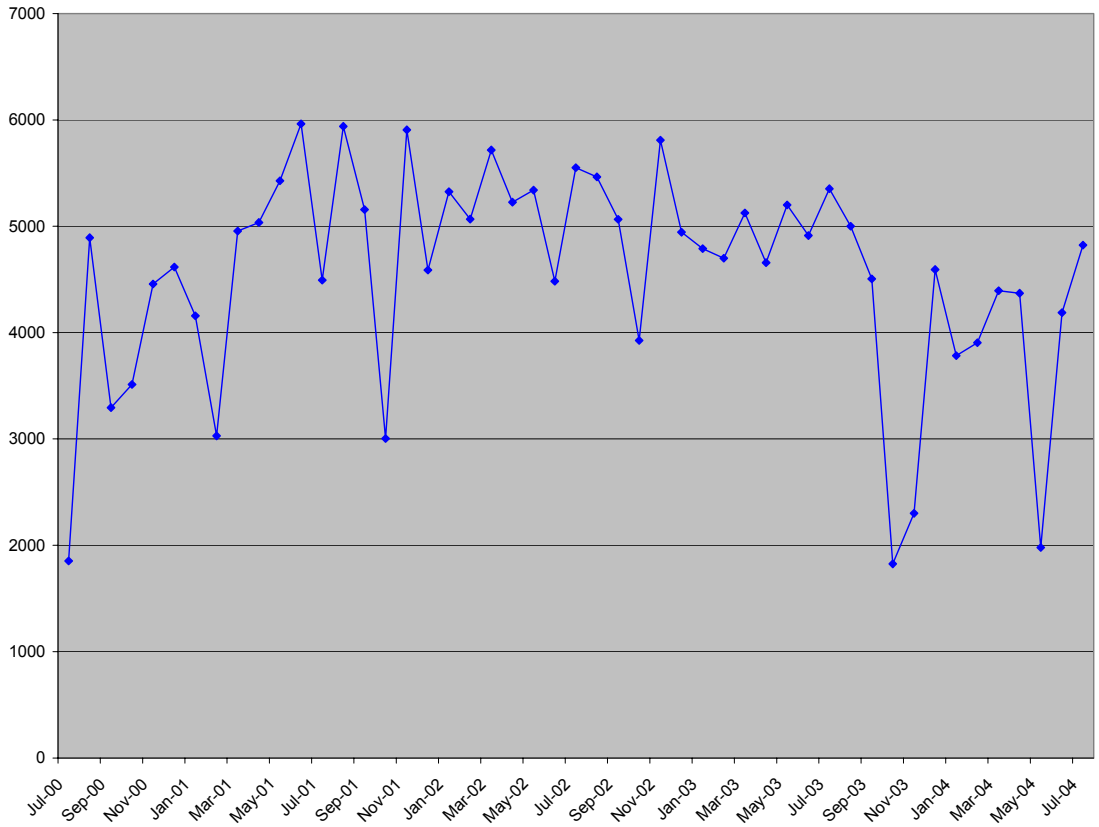
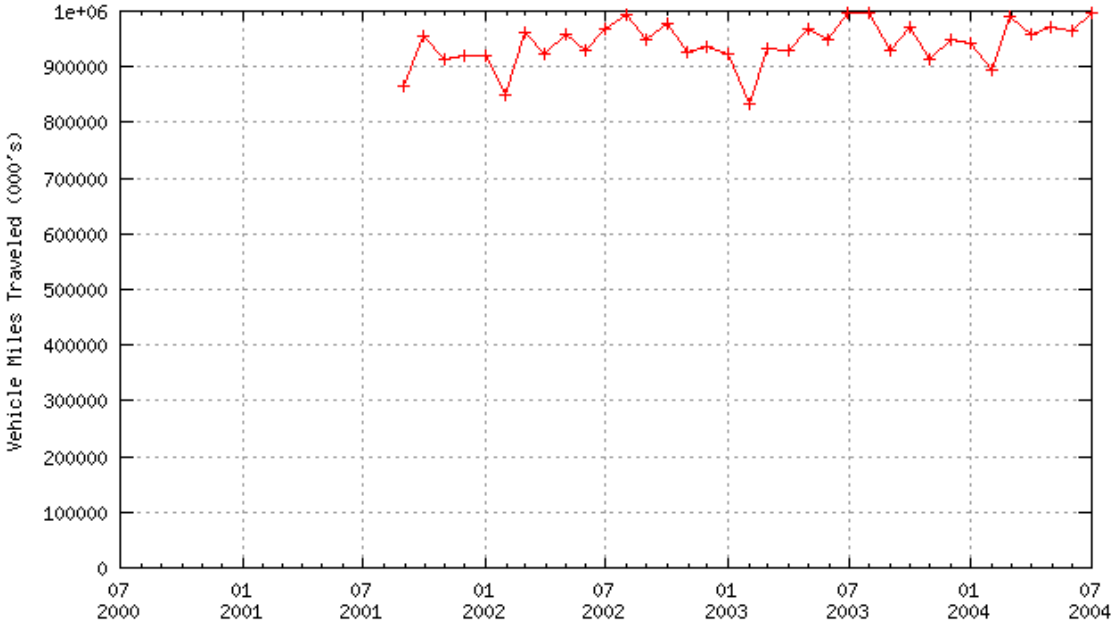


Exhibit 14 – Vehicle Miles Traveled (VMT) in Orange County



San Diego Region

During the period of the evaluation, usage of Mission Valley ATMIS was light and periodic, and the system did not reach a level of stable, steady-state operation that would permit a meaningful evaluation of its impacts to incident reduction.

Objective 5.3 – Impacts to Traffic Congestion

Los Angeles-Ventura Region

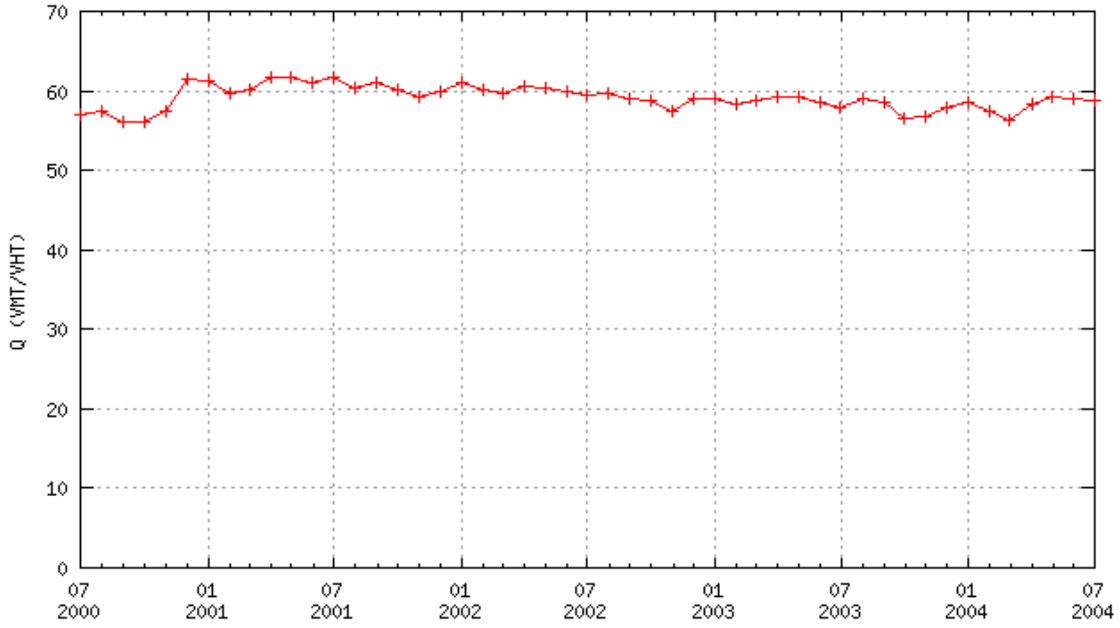
In a survey of TANN website users conducted by the Volpe Center in coordination with the Showcase Evaluation team, 66% reported a likeliness to change their departure time when learning of an incident before leaving home to go ***to*** work or school. A similar number of TANN survey respondents (67%) are also just as likely to take an alternate route. 19% would run errands or make stops that they otherwise would not have made, while 27% report that they would make no changes to their morning commute and travel as normal.

Behaviors during the afternoon commute ***from*** work/school back home follow a similar trend. 71% of respondents say they would change their departure time when learning of an incident. 70% would make minor route changes, while 60% would consider entirely different routes. As might be expected, respondents are more likely to run errands or make otherwise unplanned stops during the afternoon commute (33%) than during the morning commute (19%).

Perhaps more revealing, 87% of TANN survey respondents reported that traffic information has saved them time, and 78% report that the traffic information has helped them avoid traffic problems.

Although neither IMAJINE, LA-Ventura ATIS nor Modeshift currently get enough use to significantly impact overall traffic conditions, an analysis was conducted to study the possible impacts from TANN. Exhibit 15 shows Vehicle Miles Traveled (VMT) divided by Vehicle Hours Traveled (VHT) – represented as "Q" – aggregated over all highway miles in Los Angeles County between July 2000 and July 2004. The exhibit shows that overall traffic speeds have decreased in Los Angeles County over the past few years. While some might argue that this implies that traveler information systems have been ineffectual at reducing traffic delay, others might argue that this implies a growing need for more ATIS support.

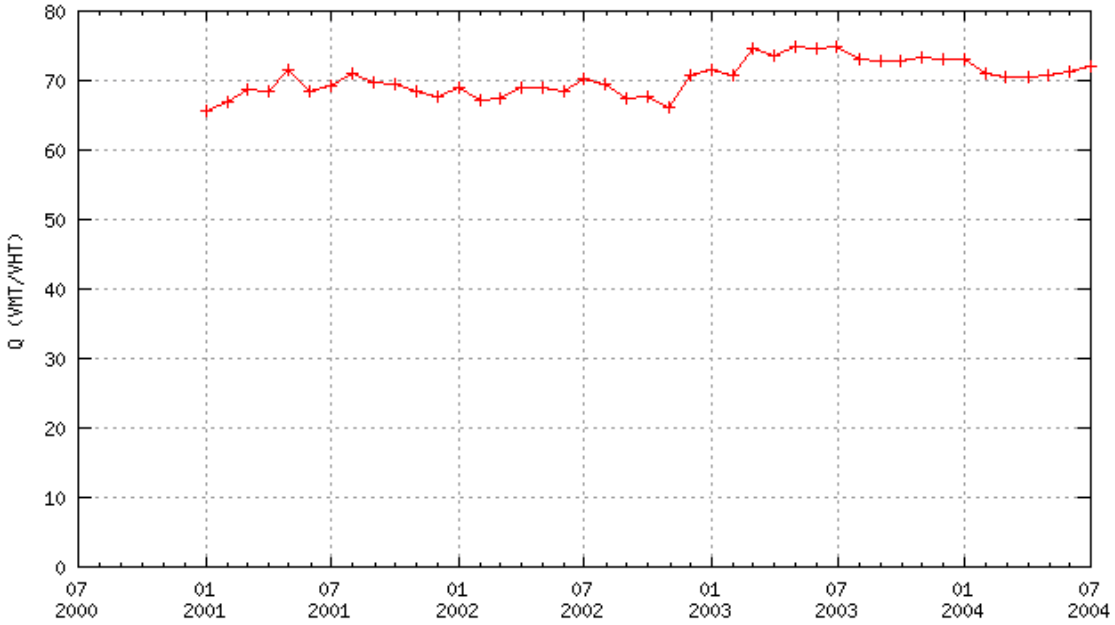
Exhibit 15 – Q (VMT/VHT) over Time for Los Angeles County Highways



Inland Empire

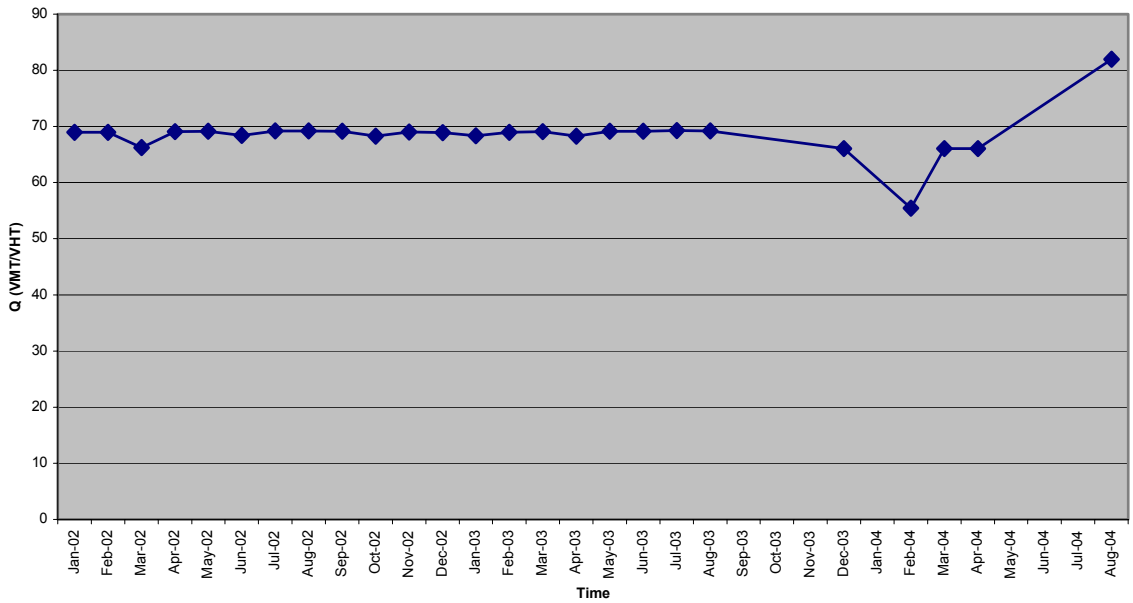
Exhibit 16 shows Vehicle Miles Traveled (VMT) divided by Vehicle Hours Traveled (VHT) aggregated over all highway miles in San Bernardino County between July 2000 and July 2004. At the time the Fontana-Ontario ATMIS went live in February 2003, VMT/VHT was in an upward trend and rose approximately 2.9% from roughly 69 to 71. Although many factors, including road improvements, may have contributed to this change, the ATMIS cannot be ruled out as one of them.

Exhibit 16 – Q (VMT/VHT) over Time for San Bernardino County Highways



However, Fontana represents only a small portion of the entire Inland Empire. To focus more specifically on the Fontana area, data for Interstate 15 between post miles 106.7 – 115.5 were analyzed separately from other Inland Empire data. Exhibit 17 shows these results.

Exhibit 17 – Q (VMT/VHT) for I-15 near Fontana, California



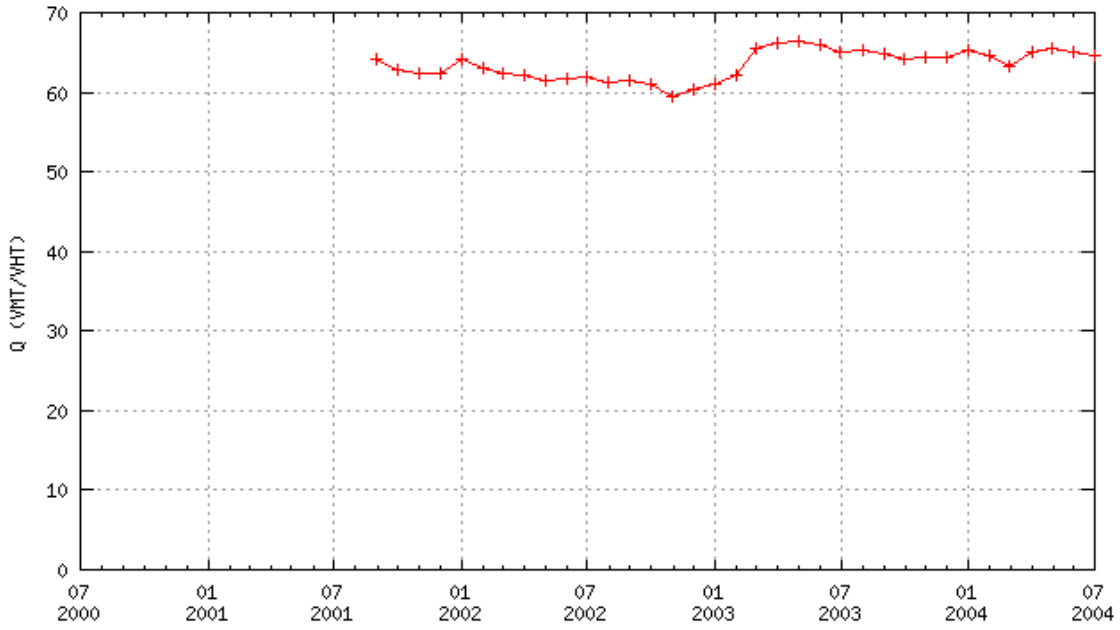
It is not clear why VMT/VHT dropped and then shot up so significantly in the past year. One interpretation of the data is that traffic might have slowed and then greatly improved due to the construction and subsequent opening of a new exit or an added freeway lane. As of the writing of this report, the evaluation is awaiting confirmation as to whether such construction took place during that time near this stretch of Interstate 15.

Although Interstate 10 also passes close to Fontana, there are no detectors in that vicinity (between post miles 57.61 – 65.56) on which to base an analysis.

Orange County Region

As shown in Exhibit 18, an analysis of *Q* for Orange County's highways and freeways shows a run-up in average traffic speed (a reduction in delay) in early 2003. It is not clear why the overall delay decreased so drastically between January 2003 and April 2003.

Exhibit 18 – Q (VMT/VHT) over Time for Orange County Highways



San Diego Region

Mission Valley ATMIS

During the period of the evaluation, usage of Mission Valley ATMIS was light and periodic, and the system did not reach a level of stable, steady-state operation that would permit a meaningful evaluation of its impacts to traffic congestion.

Likewise, although the Regional Automatic Vehicle Location (RAVL) project will deploy traffic signal priority (TSP) at seven locations along Harbor Drive between San Diego International Airport and downtown San Diego, an assessment of the impact of TSP could not be performed because full deployment was not completed as of the writing of this report.

Objective 5.4 – Impacts to the Environment

Due to currently low utilization of the Showcase systems, an empirical analysis to detect their impacts on air quality and the environment was not performed. As a result, this section can only theorize about the potential impacts that traveler information might have on automobile emissions and air quality.

Through the combustion of fossil fuels and air, automobile engines produce carbon monoxide (CO), nitrogen oxides (NOx), and water vapor. In the presence of sunlight, these CO and NOx emissions contribute to the formation of ground level ozone and smog. The amount of CO and NOx emitted by an automobile engine varies by its age and condition, the amount of load on the engine (whether it is idling or not), and the ambient temperature. The United States Environmental Protection Agency (EPA) publishes average "exhaust emission factors" for engines under various conditions, and these factors can be used to roughly estimate the amount of exhaust emissions produced or mitigated under various scenarios.

Exhibit 19 – Exhaust Emissions Factors in Grams/Mile at Various Vehicle Speeds at Low Altitude and 75°F Ambient Temperature[iii]

	2.5MPH (Idle)	35MPH	55MPH	65MPH
Carbon Monoxide (CO)	83.58	9.80	7.45	15.90
Nitrogen Oxides (NOx)	3.14	2.04	2.65	3.51

Consider a scenario in which a vehicle encounters an incident that has caused traffic to back up for one mile. According to the EPA's Exhaust Emissions Factors, that one vehicle would generate roughly 84 grams of CO and just over 3 grams of NOx while inching through the backup at 2.5 MPH. A total traffic standstill would generate even more emissions.

The emissions factors in Exhibit 19 imply certain emissions-related benefits to using traveler information to avoid traffic congestion. These benefits are described in general below. Since there are virtually endless scenarios to consider, the reader is invited to use the information provided in this section to quantify his or her own specific benefits.

Exhibit 20 – Anticipated Air Quality/Emissions Benefits of Using Traveler Information

Mitigating Action	Benefit
Change Departure Time	Enables vehicle to travel at higher speed by picking a time when congestion is less severe. Consider a scenario in which an "average" vehicle typically travels 30 miles between home and work, with 7 miles of travel on local streets at 35MPH and 23 miles of travel on freeways at 65MPH. On a typical day, CO output from this trip might be roughly 434.3 grams. However, a one-mile delay (travel at 2.5MPH) on the arterial portion of the trip would inflate the total CO production to 508.08 grams, while a one-mile delay on the freeway portion would result in the production of 501.98 grams. Under this scenario, each vehicle that avoids the traffic congestion could avoid producing as much as 17% greater CO emissions.
Cancel Trip	At best, canceling the trip means that no emissions are generated. At worst, the emissions that would have been generated during the trip are simply deferred to another time.
Take Alternate Route	Since the amount of CO produced at idle is so much more than that produced at higher vehicle speeds, a vehicle could take an alternate route that is longer than the normal route taken and still produce less total exhaust emissions in the process. Using the scenario above, this vehicle could travel up to twice as far on an alternate set of arterials, or roughly 20% farther on an alternate set of freeways.
Take Transit/Carpool	One less vehicle on the road means that much fewer emissions generated. The fewer the vehicles on the road, the higher the travel speeds, which can also reduce emissions further.

Objective 5.5 – Impacts to Transit Operations

Los Angeles-Ventura Region

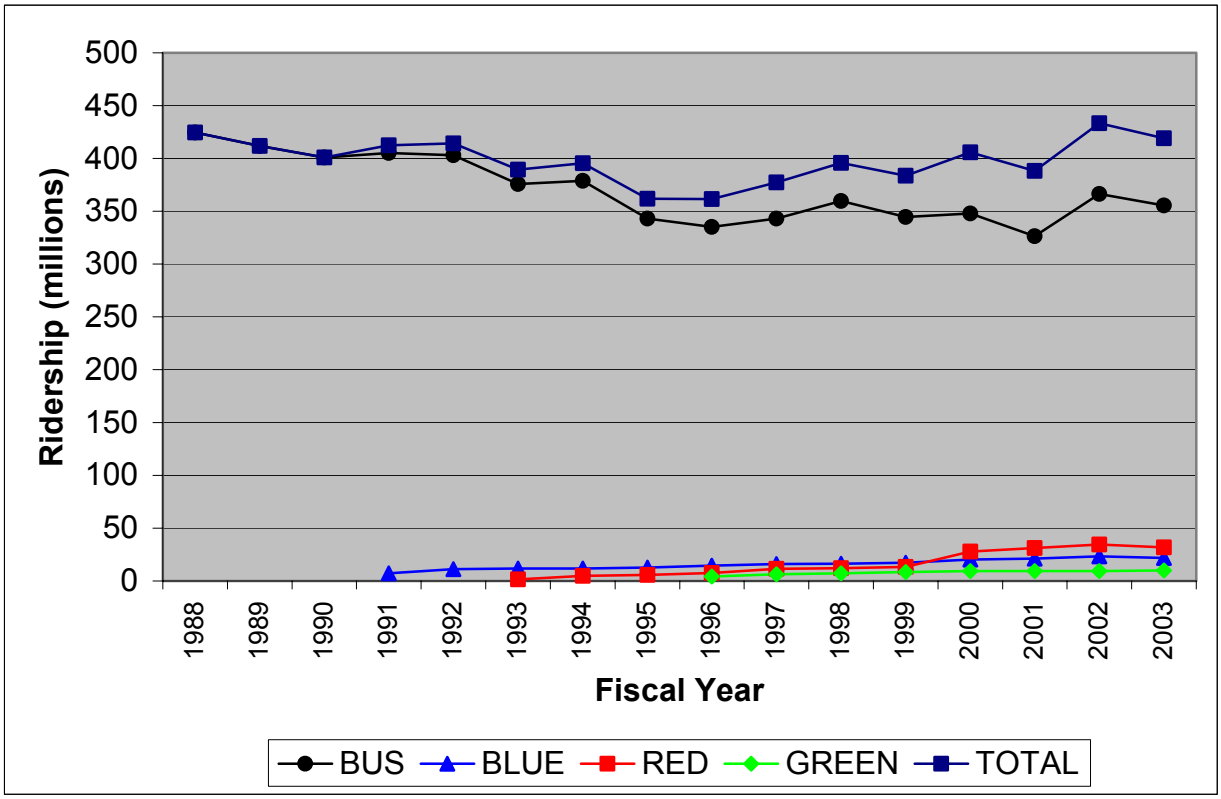
As shown in Exhibit 21, overall ridership on Los Angeles MTA buses and light rail decreased between fiscal years 1988 to 1995, despite the opening of the Blue Line and Red Line in the early 1990's. The trend reversed in the second half of the 1990's, aided somewhat by the opening of the Green Line, and overall ridership has generally been on the rise into 2003. This year's opening of the MTA's Gold Line will likely help maintain that growing trend.

These changes are not believed to be related to IMAJINE, LA-Ventura ATIS, Modeshift, or TANN. IMAJINE's traffic signal priority feature will help improve transit speeds and on-time performance only after the AVL system has been installed. LA-Ventura ATIS is not yet

available to the public, and Modeshift's intial deployment is restricted to a relatively small geographic area. TANN does not currently provide transit route or schedule data, and relatively few of the User Survey respondents indicated a likelihood to shift modes as a result of traffic data received through the TANN website.

These findings do not mean that more significant impact might not be experienced later in the future as Southern California's population continues to grow, traffic conditions worsen, and more commuters make use of the available traveler information. In short, it is too early to tell, and a longer-term study involving more extensive user surveys would be required to draw definitive conclusions.

Exhibit 21 – Annual Ridership in Millions on MTA Bus and Rail Lines



Inland Empire

The Fontana-Ontario ATMIS project was not intended to impact transit operations, so an evaluation of its impacts to transit operations was not conducted.

Orange County Region

OCTA enacted a major service change in September 2000, rendering bus ridership data that had been collected by the evaluation up to that point useless for determining a before-and-after impact. However, additional data collected during the TravelTIP online survey indicates that much fewer users visited the site for transit information than for traffic information. Of the survey's 170 respondents, 40 (or 24%) reported using TravelTIP's transit page as compared to the 169 (99%) who reported using the traffic page. One reason for this may be because TravelTIP's transit page simply provides links to existing route and schedule information on other websites (an economical approach that avoided "reinventing the wheel"). Users interested only in transit information can simply "bookmark" those other sites and return to them directly without having to go through TravelTIP.

Traffic	Transit	Count	Percent
No	Yes	1	1%
Yes	No	130	76%
Yes	Yes	39	23%
Total		**170**	**100%**

Exclusions: 1 respondent checked 'no' for both traffic and transit.

San Diego Region

Showcase's greatest potential impact to transit operations in the San Diego region will be through the Regional Automatic Vehicle Location (RAVL) project. The primary benefit of RAVL, once completed, will be the implementation of upgrades and communications that represent a major advancement in the level of operational capabilities available to transit operators in the San Diego region. As the operational concepts that are part of the RAVL project expand to wider segments of the transit fleet, the capabilities of transit operators to respond more quickly and efficiently to changes in the operating environment will continue to improve.

A major component of the RAVL system is the deployment of Transit Signal Priority (TSP) on Bus Route 992 along Harbor Drive. TransitMaster software activates 3M 7000 series Opticom emitter placed on Route 992 vehicles. The City of San Diego provided signal controller cards and equipment that were deployed along Harbor Drive. This project is noteworthy because it represents the first opportunity in the San Diego region to assess operational issues relating to the integration of CAD/AVL and TSP systems.

There are several potential benefits associated with TSP implementation:

- Schedule reliability
- Reduced travel times
- Reduced wear-and-tear on transit vehicles
- Increased rider comfort
- Reduced emissions
- Increased competitiveness of transit compared to single occupant vehicle travel.

Much of the benefit of CAD/AVL functions is manifested in the dispatcher's ability to respond to operating conditions that impact service delivery. The AVL function may have the potential to render transit operations more transparent, and improved voice and data communications can shorten response time to unanticipated events that impact service delivery. From a customer interface standpoint, it is anticipated that dispatch will be able to readjust next stop information to passengers waiting at stations relatively seamlessly, effectively mitigating to customers the unpleasantness associated with wait time.

Conclusions

This cross-cutting report aggregates and summarizes the cumulative knowledge gained from the Showcase Program projects with regards to Transportation System Impacts.

For several of the Showcase projects, an evaluation of transportation system impacts was deemed unwarranted due to observed low or insignificant usage of the deployed ITS. It was not feasible to measure their impact on travel adjustments (by time of day and route), mode shifts, traffic safety, or air quality in a comprehensive and scientifically robust cost/benefit manner because they had not sufficiently penetrated the traveler information marketplace. In short, for most of the systems, it is too early to tell what the impacts might be. These treatments must be given more time to work. A more thorough impacts analysis of these systems might be warranted once greater usage is achieved.

In the remaining cases, trends in transportation system performance were extrapolated from survey responses or calculated using archived data from California's Highway Performance Measurement System (PeMS), which is the result of a joint effort between Caltrans and the Partnership for Advanced Transit and Highways (PATH) at UC-Berkeley. PeMS collects, validates, and archives incident statistics and real-time loop detector data for highways around the state, as well as provides access to various analytical tools via a web-enabled interface. The evaluation looked for changes in transportation system performance by looking at data from before and after the various Showcase systems became operational. However, because Showcase is deployed in a "real-world" environment and is subject to many influences beyond the control of the evaluation, this report can neither show nor prove a direct or exclusive causal relationship between the Showcase systems and the trends observed. The reader should consider the Showcase systems to be among the many contributing factors that may have resulted in the observed trends.

Results are summarized by evaluation objective below.

Mode shift and intermodal impacts resulting from the Showcase Projects

During the Showcase Program, the Evaluation team worked in coordination with the Volpe Center during a survey of ATIS users in the Los Angeles area. A relative minority of the survey respondents indicated that they would shift transportation modes if they learned of an incident impacting their typical route. For the morning commute ***to*** work or school, 6% indicated that they would change modes. This percentage drops to 4% for the afternoon commute home.

According to the Evaluation's TravelTIP survey, however, 10% of respondents reported having used public transit at least once as a result of learning of a traffic incident through TravelTIP. Extrapolating this percentage to all TravelTIP users, this might have resulted in as many as 960 people temporarily shifting to transit.

A larger number of TravelTIP survey respondents (15%) reported having ever switched from using transit to driving an automobile at least once as a result of TravelTIP. This may be indicative of several possible scenarios, including (but not limited to):

- Voluntary transit users (i.e., those who choose to use transit, but also have automobiles and do not necessarily depend on transit) who would rather sit in traffic in their own automobile versus aboard a bus.

- Voluntary transit users who choose to drive so as to depart at a different time or take an alternate route.

The safety-related impacts of the Showcase projects

PeMS data indicates that incident rates have decreased in the past year, while VMT has risen or stayed the same. Although this is a positive sign, the effect cannot be directly linked to the Showcase systems. Since 2002, most Showcase traveler information systems have been non-operational or underutilized by the public, with the exception of the Traveler Advisory News Network (TANN). TANN provides packaged traveler information services to traditional news media outlets such as television and radio, as well as maintains its own traveler information website.

The impact of Showcase projects on traffic congestion

In a survey of TANN website users conducted by the Volpe Center in coordination with the Showcase Evaluation team, 66% reported a likeliness to change their departure time when learning of an incident before leaving home to go ***to*** work or school. A similar number of TANN survey respondents (67%) are also just as likely to take an alternate route. 19% would run errands or make stops that they otherwise would not have made, while 27% report that they would make no changes to their morning commute and travel as normal.

Behaviors during the afternoon commute ***from*** work/school back home follow a similar trend. 71% of respondents say they would change their departure time when learning of an incident. 70% would make minor route changes, while 60% would consider entirely different routes. As might be expected, respondents are more likely to run errands or make otherwise unplanned stops during the afternoon commute (33%) than during the morning commute (19%).

Perhaps more revealing, 87% of TANN survey respondents reported that traffic information has saved them time, and 78% report that the traffic information has helped them avoid traffic problems.

The Evaluation believes that, at this time, traveler information seems to benefit a relatively small number of commuters who are exceptionally motivated to actively seek out traveler information sources. The number of such commuters is generally too small to have any significant impact on overall, network-wide traffic conditions.

The environmental impacts of the Showcase projects

Due to currently low utilization of the Showcase systems, an empirical analysis to detect their impacts on air quality and the environment was not performed. As a result, this report can only theorize about the potential impacts that traveler information might have on automobile emissions and air quality. These benefits are described in general in the following table. Since there are virtually endless scenarios to consider, the reader is invited to use the information provided to quantify his or her own specific benefits.

Anticipated Air Quality/Emissions Benefits of Using Traveler Information

Mitigating Action	Benefit
Change Departure Time	Enables vehicle to travel at higher speed by picking a time when congestion is less severe. Consider a scenario in which an "average" vehicle typically travels 30 miles between home and work, with 7 miles of travel on local streets at 35MPH and 23 miles of travel on freeways at 65MPH. On a typical day, CO output from this trip might be roughly 434.3 grams. However, a one-mile delay (travel at 2.5MPH) on the arterial portion of the trip would inflate the total CO production to 508.08 grams, while a one-mile delay on the freeway portion would result in the production of 501.98 grams. Under this scenario, each vehicle that avoids the traffic congestion could avoid producing as much as 17% greater CO emissions.
Cancel Trip	At best, canceling the trip means that no emissions are generated. At worst, the emissions that would have been generated during the trip are simply deferred to another time.
Take Alternate Route	Since the amount of CO produced at idle is so much more than that produced at higher vehicle speeds, a vehicle could take an alternate route that is longer than the normal route taken and still produce less total exhaust emissions in the process. Using the scenario above, this vehicle could travel up to twice as far on an alternate set of arterials, or roughly 20% farther on an alternate set of freeways.
Take Transit/Carpool	One less vehicle on the road means that much fewer emissions generated. The fewer the vehicles on the road, the higher the travel speeds, which can also reduce emissions further.

The impact of Showcase projects on transit operations

At this time, the Showcase projects have had limited impact on transit operations. These findings do not mean that more significant impact might not be experienced later in the future as Southern California's population continues to grow, traffic conditions worsen, and more commuters make use of the available traveler information. In short, it is too early to tell, and a longer-term study involving more extensive user surveys would be required to draw definitive conclusions.

References

[i] California Statistical Abstract, Table B-4. California Department of Finance, Sacramento, CA. December 2003.

[ii] California Statistical Abstract, Table J-4. California Department of Finance, Sacramento, CA. December 2003.

[iii] United States Environmental Protection Agency, Office of Mobile Sources, AP-42, Air Pollutant Emissions Factors, Tables 1.08-1.21, 1998.